

SYLLABUS
Fall semester 2025 – 2026 academic year
Educational program " 6B05405-Applied Mathematics

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
DU 2211, DU 2212 Differential Equations	3	1,7	3,3		5	7
ACADEMIC INFORMATION ABOUT THE COURSE						
Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control		
Offline/hybrid		Theoretical	Collective lesson, application of theoretical knowledge in problem solving	Oral exam		
Lecturer - (s)	Atakhan Nilupar PhD, senior lecture					
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ACADEMIC COURSE PRESENTATION						
Purpose of the course	Expected Learning Outcomes (LO) * Describe what is the result of studying the course the student will be able to:			Indicators of LO achievement (ID) Demonstrated ability to use knowledge, skills, abilities in learning and practice, which students will be able to demonstrate in LO (at least 2 per LO)		
Introduce the basic concepts of the theory of differential and integral equations. To train students to master the methods of the theory of differential and integral equations. To instill in students problem-solving skills: determine the type of equations and select a method for integrating it.	1.Be able to integrate homogeneous and linear differential equations of the first order.			1.1 Be able to integrate a homogeneous first order differential equation.		
				1.2 Be able to integrate first order linear differential equations.		
	2. Be able to integrate equations in total differentials and first-order differential equations unresolved with respect to the derivative.			2.1 Be able to integrate equations in total differentials.		
				2.2 Be able to integrate, by introducing a parameter, first-order differential equations unresolved with respect to the derivative.		
	3. Know higher order differential equations.			3.1 Be able to integrate differential equations that allow reductions in order.		
				3.2 Be able to integrate linear homogeneous and inhomogeneous differential equations with constant coefficients.		
	4. Know a linear boundary value problem for a second order linear differential equation.			4.1 Know the formulation of a linear boundary value problem.		
				4.2 Know the green's function and its construction.		
	5. Know a linear system of differential equations.			5.1 Be able to integrate linear homogeneous and inhomogeneous systems of differential equations with constant coefficients.		

		5.2 Know a system of differential equations by the elimination method.
Prerequisites	Mathematical analysis, linear algebra, analytical geometry	
Postrequisites	Second order partial differential equations, mathematical physics equations and special courses	
Learning Resources	Literature: 1. V.I.Smirnov. A- Course of Higher Mathematics. Volume I. Translated by D.E. Brown- Addison-Wesley Publishing Company, INC. Reading, Massachusetts - Palo Alto - London - 1964 2. Andrew Baker. Basic Linear algebra - Department of Mathematics, University of Glasgow. - 2009. 3. Tom Denton and Andrew Waldron. Linear Algebra in Twenty Five Lectures - 2012 4. Konev-Linear_Algebra_Vector_Algebra_and_Analytical_GeomI 5. Konev-Limits_of_Sequences_and_Functions_Textbook 6. Махмеджанов Н.М. Сборник задач по высшей математике –Алматы, Дауip _ 2009. 7. S.Salas, G.Etgen, E.Hille. Calculus: One and Several Variables; Wiley 10 edition, 1168p, 2006. 9. Под ред. Н.Ш.Кремера и др. Высшая математика для экономистов. – М.: ЮНИТИ, 1999- 471 с. 10. Jim Hefferon, Linear Algebra. Available at: http://ihtik.lib.ru/2012.03_ihtik_mathematic/2012.03_ihtik_mathematic_3187.rar 11. Эльсгольц Л. Дифференциальные уравнения. — М.: 2013. — 320 с; 12. Филиппов А.Ф. Сборник задач по дифференциальным уравнениям. Издание третье. Москва. Издательство «Книжный дом». 2009. -240 стр; 13. Степанов В.В. Курс дифференциальных уравнений. М.: Изд-во "ЛКИ", 2008. 472 с. 14. Петровский И.Г. Лекции по теории обыкновенных дифференциальных уравнений. Издание седьмое. - М.: Наука, 1984. 296 стр; 15. Самойленко А.М., Кривошея С.А., Перестюк Н.А. Дифференциальные уравнения. Примеры и задачи. М: Высшая школа, 2006 г. 16. Понтрягин Л.С. Обыкновенные дифференциальные уравнения. Издание пятое. Москва «Наука». Главная редакция физико-математической литературы. 1982. 331 стр; 17. Тихонов А.Н., Васильева А.Б., Свешникова А.Г. Дифференциальные уравнения. Москва «Наука». Главная редакция физико-математической литературы. 1980. 232 стр; 18. Эльсгольц Л.Э. Дифференциальные уравнения и вариационное исчисление. Издание второе. Издательство «Наука». Главная редакция физико-математической литературы. Москва. 1969. 424 стр; Internet-resources: 1. https://educon.by/index.php/materials/hmath/osnovy 2. https://ru.wikibooks.org/wiki/Высшая_математика. 3. univer.kaznu.kz. 4. Электронная библиотека механико-математического факультета МГУ. http://lib.mexmat.ru Бесплатный ресурс для студентов – http://math24.ru/index.html	

Academic course policy	The academic policy of the course is determined by the <u>Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University</u>. Documents are available on the main page of IS Univer . Integration of science and education. The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWS, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments. Attendance. The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points. Academic honesty. Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the <u>"Rules for the final control"</u> , <u>"Instructions for the final control of the autumn / spring semester of the current academic year"</u> , <u>"Regulations on checking students' text documents for borrowings"</u>. Documents are available on the main page of IS Univer . Basic principles of inclusive education. The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail <u>enter teacher's contacts</u> or via video link in MS Teams <u>enter a permanent link to the meeting</u>. Integration MOOC (massive open online course). In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule. ATTENTION! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.
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INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements				Assessment Methods	
Grade	Digital equivalent points	points, % content	Assessment according to the traditional system	Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment. Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed. Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.	
A	4.0 _	95-100	Great		
A-	3.67	90-94			
B+	3.33	85-89	Fine		
B	3.0	80-84		Formative and summative assessment The teacher introduces his own types of assessment or uses the proposed option	Points % content The teacher enters his score into points in accordance with the calendar (schedule).

					The exam does not change and the final score in the course.
B-	2.67	75-79		Activity at lectures	5
C+	2.33	70-74		Work in practical classes	20
C	2.0	65-69	Satisfactorily	Independent work	25
C-	1.67	60-64		Design and creative activity	10
D+	1.33	55-59		Final control (exam)	40
D	1.0	50-54		TOTAL	100
FX	0,5	25-49	Unsatisfactory		
F	0	0-24			

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

A week	Topic name	Number of hours	Max. ball
MODULE 1 General concepts. First-order differential equations			
1	L 1. First order differential equations. General concepts. Equations with separable variables.	1	
	Seminar 1. First order differential equations with separable variables and reducible to them.	2	
2	L 2. Homogeneous differential equations. Equations reducing to homogeneous equations.	1	
	Seminar 2. Homogeneous differential equations. Equations reducing to homogeneous equations.	2	
3	L 3. Linear differential equations of the first order. Bernoulli and Riccati equations.	1	
	Seminar 3. Linear differential equations of the first order. Bernoulli and Riccati equations.	2	
4	L 4. Equations in total differentials.	1	2
	Seminar 4. Equations in total differentials.	2	8
5	L 5. Parameter introduction method. Lagrange and Clairaut equations.	1	2
	Seminar 5. Parameter introduction method. Lagrange and Clairaut equations.	2	2
MODULE 2 Title Higher order differential equations			
6	L 6. Differential equations that allow reductions in order.	1	2
	Seminar 6. Differential equations that allow reductions in order.	2	2
	IWS control work 1		25
7	L 7. Linear differential equations of higher orders. Linear homogeneous differential equation with constant coefficients.	1	2
	Seminar 7. Linear differential equations of higher orders. Linear homogeneous differential equation with constant coefficients.	2	16
8	L 8. Linear inhomogeneous differential equation of higher order. Linear inhomogeneous differential equations with constant coefficients with the right- hand side of a quasipolynomial.	1	12
	Seminar 8. Linear inhomogeneous differential equation of higher order. Linear inhomogeneous differential equations with constant coefficients with the right-hand side of a quasipolynomial.	2	2
	IWS control work 2		25
Midterm control 1			100
9	L 9. Method of variation of Lagrange constants for a linear differential equation of the n-th order.	1	2
	Seminar 9. Method of variation of Lagrange constants for a linear differential equation of the n-th order.	2	2
MODULE 3 Title System of differential equations			
10	L 10. Linear boundary value problem for a second-order linear differential equation.	1	2

	Seminar 10. Linear boundary value problem for a second order linear differential equation.	2	2
11	L 11. Linear homogeneous systems of differential equations. Properties. Common decision.	1	2
	Seminar 11. Linear homogeneous systems of differential equations with constant coefficients.	2	2
12	L12. Wronskian. Properties. Ostrogradsky-Liouville formula for a linear homogeneous system of differential equations of the n-th order.	1	2
	Seminar 12. Linear inhomogeneous systems of differential equations with constant coefficients. Method of variation of Lagrange constants for a linear system of differential equations.	2	2
MODULE 4 Title Linear equations with first-order independent derivatives			
13	L 13. Linear homogeneous and inhomogeneous partial differential equations of the first order.	1	2
	Seminar 13. Integration of LODE and LDDE.	2	2
	IWS control work 3		25
14	L 14. Systems of differential equations (elimination method).	1	2
	Seminar 14. Solve a system of differential equations by the elimination method.	2	18
15	L 15. Nonlinear system.Examples.	1	8
	Seminar 15. Solve nonlinear systems	2	2
	IWS control work 4		25
Midterm control 2			100
Final control (exam)			100
TOTAL for course			100

Dean _____ M.Bektemesov

Chair of the Academic Committee _____ B. Akhmetova
on the Quality of Teaching and Learning

Head of Department _____ C.E. Kasenov

Lecturer _____ N.Atakhan

RUBRICATOR OF THE SUMMATIVE ASSESSMENT **CRITERIA EVALUATION OF LEARNING OUTCOMES**

Issued for each planned summative assessment (IWST)

TEMPLATE

Task name (points, % content from 100% MC, copy from the calendar (graphics) implementation of the content of the training course, methods of teaching and learning

Criterion	"Excellent" Max. weight in %	"Good" Max. weight in %	"Satisfactory" Max. weight in %	"Unsatisfactory" Max. weight in %

Formula for calculating the final grade (obtaining the average value):
Final grade = (%1+%2+%3+%4+%5+... by the number of criteria / K,
where % is the level of task completion by criterion,
K is the total number of criteria in the rubricator.

Example 1. Written assignment "My professional history" (25% of 100% MC)

Criterion	"Excellent" 20-25%	"Good" 15-20%	"Satisfactory" 10-15%	"Unsatisfactory" 0-10%
Understanding Theories and concepts of professional identity and professionalism of a teacher	Deep understanding of theories, concepts of professional identity and teacher professionalism. Relevant and relevant links (citations) to key sources are provided.	Understanding theories, concepts of professional identity and teacher professionalism. Links (citations) to key sources are provided.	Limited understanding of theories, concepts of professional identity and teacher professionalism. Limited references (citations) to key sources are provided.	Superficial understanding / lack of understanding of theories, concepts of professional identity and professionalism of the teacher. Relevant references (citations) to key sources are not provided.
Awareness of key issues of professional identity and professionalism of teachers in Kazakhstan	Links well the key concepts of professional identity and teacher professionalism with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	Links the concepts of professional identity and teacher professionalism with the context of Kazakhstan. Supports arguments with evidence from empirical research.	Limited connection of the concepts of professional identity and professionalism of teachers with the context of Kazakhstan. Limited use of evidence from empirical research.	There is little or no connection between the concepts of a teacher's professional identity and the context of Kazakhstan. Little or no use of empirical research.
Policy proposal or practical recommendations/suggestions	Offers sound policy and/or practical recommendations.	Offers some policy and/or practical recommendations,	Limited policy and practical recommendations. Recommendations are	Little or no policy and practice advice, or advice of very low quality.

	proposals for improving the professional identity and professionalism of teachers in Kazakhstan.	proposals for enhancing the professional identity and professionalism of teachers in Kazakhstan	non-essential, not based on rigorous analysis, and are shallow.	
Letter, APA style	The writing demonstrates clarity, conciseness and correctness. Strictly follows the APA style.	The letter demonstrates clarity, conciseness and correctness. Basically follows the APA style.	The letter has some key errors and clarity needs to be improved. There are mistakes in following the APA style.	The writing is unclear, it is difficult to follow the content. Lots of mistakes in following the APA style.

Example 2. Group presentation "Teaching profession in Kazakhstan" (30% of 100% RK)

Criterion	"Excellent" 25-30%	"Good" 20-20%	"Satisfactory" 15-20%	"Unsatisfactory" 0 – 15%
Understanding theories and concepts of the professional identity of the teacher and the teaching profession	Deep understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Understanding theories, concepts of the professional identity of the teacher and the teaching profession.	Limited understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Superficial understanding / lack of understanding of theories, concepts of the professional identity of the teacher and the teaching profession.
Awareness of key issues of the professional identity of the teacher and the teaching profession in Kazakhstan	Competent correlation of the key concepts of the professional identity of the teacher and the teaching profession with the context of Kazakhstan. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	There is a connection between the concepts of professional identity of a teacher and the teaching profession with the context of Kazakhstan. The arguments are backed by evidence from empirical research.	Limited correlation of the professional identity of the teacher and the concepts of the teaching profession with the context of Kazakhstan. Limited use of evidence from empirical research	Insignificant connection / lack of connection between the concepts of the teacher's professional identity and the context of Kazakhstan. Little or no empirical research is used.
Pilot Study	Excellent use of the results of pilot studies (interviews or surveys) in the presentation	Good use of the results of pilot studies (interviews or surveys) in the presentation.	Satisfactory use of the results of pilot studies (interviews or surveys) in the presentation.	Poor use of the results of pilot studies (interviews or surveys) in the presentation.
Suggestion of policy or practical recommendations/suggestions	Offers very good policy and/or practical advice or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Offers some policy and/or practical recommendations or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.	Little or no policy and practice advice, or advice of very low quality.
Presentation, teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality visuals, slides or other materials, good teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low engagement, low quality content, poor teamwork.